

NORTHERN TERRITORY *TERMITIDÆ*. PART I.

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NORTHERN TERRITORY.

(Plates xiv.-xxiii.)

The following contribution to a knowledge of the Australian *Termitidæ* has been prepared from part of a large collection of Termites, and many field-notes compiled during the past two years, in what may be termed the coastal region of the Northern Territory.

Fifteen species are dealt with in this paper, eight of which are described as new. One new species is recorded from Melville Island; the remainder are from localities situated within 70 miles of Darwin, and within 20 miles of the Darwin-Pine Creek Railway. The Departmental collection contains about 27 species from the latter area, but it is probable that the number will be brought up to 30 or more when the whole collection has been worked out.

In the absence of the winged forms, it has been found impossible to determine accurately several common species of the genus *Eutermes*. These, and a few species of the genus *Termes*, which are represented in the collection by one or two examples only, have been held over until more material is available for study.

I desire to express my thanks to Mr. W. W. Froggatt, Government Entomologist of New South Wales, for his courteous assistance in determining many species submitted to him, and to acknowledge the help I have derived from a perusal of his works on Australian Termites.

HETEROTERMES VALIDUS, sp.nov.

Winged form.—General colour ochreous, legs and antennæ paler; wings pale fuscous tinged with ochreous, nervures fuscous;

clypeus pale yellow; labrum pale ferruginous. Length to tip of body $4\frac{1}{2}$ mm.; to tip of wings 10 mm. Head large, longer than broad, rounded behind; forehead prominent, flattened, divided from the posterior part of the head by a wide, curved suture passing in front of the eyes and extending back to a point in line with the posterior margin of the eyes, a small circular excrescence in the centre of the head in line with the posterior margin of the eyes; clypeus large, arcuate behind, slightly rounded on the sides, truncate in front, a deep suture dividing it into two lobes, the posterior one convex and divided in the middle line by an indistinct suture; labrum long, convex, widest at the base, sloping in to the truncate apex, not reaching the tip of the jaws; eyes small, circular, coarsely faceted, projecting, placed on the sides of the head, equidistant from the apex of the labrum and the hind margin of the head; ocelli wanting. Antennæ very short, 16-jointed, springing from a circular cleft in front of the eyes, 1st joint longest; 2nd half the length, slender; 3rd very small; 3rd-10th coalesced; 11th-13th moniliform; 14th-16th hairy. Thorax covered with scattered hairs; prothorax moderately large, not as wide as head, not as long as broad, rugose on the summit, depressed at the sides, front margin turned up, notched in the centre, sides and hind margin rounded, with a slight indentation behind. Wings long (forewings 9 mm., hindwings $8\frac{1}{2}$ mm.), narrow (2 mm.), fragile, rounded at the tips. Forewing: costal nervure slender, paler than the rest; subcostal nervure stout, running close to the costal and merging into it before the middle; median stout at the base but rapidly becoming slender, curving downwards near the base below the middle line of the wing, then rising above the middle, two simple, slender, oblique nervures branching from it, the first about the middle, and both joining the hind margin well round from the apex, bifurcating at about two-thirds of its length from the base, the lower branch joining the hind margin well round from the apex, the upper branch again forked near the apex, the anterior branch joining the costal margin, the posterior the hind margin at points equidistant from the apex; submedian nervure stout at the base, slender towards the extremity, running through

the lower part of the wing at the base but rising to near the middle at a point nearly abreast of the first fork in the median nervure, joining the hind margin about three-quarters of the length of the wing from its base, with seven oblique nervures, the first four stout, simple, increasing in length; the 5th stout, with two branches; 6th and 7th slender, simple. Hindwing: costal and subcostal nervures similar to forewing; median nervure differs in that the upper branch at the apex is wanting; submedian similar to forewing excepting that there are eight oblique nervures, and that the 1st to 6th are all stout and simple, the 7th divides into three long, slender branches, the 8th long, slender, forked near its extremity. Scapular shield angular, showing four branches, cross-suture convex. Legs stout, femora with scattered hairs; tibia and tarsi covered with hairs; tibial spines long; claws long; plantula wanting. Abdomen short, swollen towards the extremity; cerci and anal appendices long, slender, hairy.

Soldier.—Head, antennæ, base of jaws and labrum bright golden; jaws dark castaneous; the rest creamy-white. Length, $5\frac{1}{2}$ mm. (head, 2 mm.; jaws, 1 mm.; thorax and abdomen, $2\frac{1}{2}$ mm.). Head long, slender, cylindrical, rounded behind, straight on the sides to the antennal cleft; forehead slightly raised on the summit, then sloping sharply to the base of the powerful jaws; a small, obscure, circular cleft in the forehead behind the raised summit. Antennæ moderately long, 17-jointed, springing from a circular cleft at the side of the head; 1st joint longest, slightly turbinate; 2nd one-half the length, cylindrical; 3rd and 4th swollen towards the apex; 5th-17th oval; 3rd-17th hairy. Clypeus moderately large, straight on the sides, flat, truncate in front. Labrum large, long, convex, widest at the base, rounded on the sides to the spade-shaped apex, which bears two long and several short, slender hairs. Jaws long, stout, flattened, slightly curved upwards and inwards (the under surface from the hind margin of the head to the tip of the jaws forming an uninterrupted curve), at the base of the left jaw a stout, blunt fang, separated by a deep cleft from a flat, irregular tooth; at the base of the right jaw a single-pointed, broad tooth opposed to the larger

tooth on the left. Prothorax heart-shaped, a little wider than long, a deep indentation in the front margin, slightly turned up in front and on the sides, the middle convex, the hind margin truncate. Abdomen short, widest at the tip, covered with stout hairs; cerci and anal appendices long, hairy. Legs strong; tibia covered with hairs; claws and tibial spines long.

Worker.—Head pale yellow, legs and antennæ paler; abdomen whitish. Length $3\frac{1}{2}$ mm. Head large, orbiculate, arcuate behind the clypeus. Antennæ 17-jointed, moderately long. Clypeus large, convex, lobed, truncate in front, a ferruginous spot at either end. Labrum large, apical two-thirds convex, spade-shaped, basal one-third narrower, with two depressions, one on either side of a median ridge, the hind margin produced at either side into a projection directed backwards. Jaws hidden by the labrum. Prothorax small, rugose, saddle-shaped; front margin rounded and turned up, with a deep median indentation; a deep indentation on either side behind the upturned front margin, sides rounded to the truncate hind margin. Abdomen elongate-oval. Cerci long, slender, hairy. Legs stout; tibia covered with bristles.

Observations on this species have been confined to a small community (1 winged insect, 12 workers, and 10 soldiers) taken in the stem of a Papaw, which had been hollowed out and filled with earthy material; and to a still smaller community found under a log at East Point, near Darwin.

Hab.—Darwin, Northern Territory (G. F. Hill, 17/12/13). Types (No.95) in the Entomologist's Office, Department of Agriculture, N.T.

TERMES NANA, sp.nov.

Winged form not known.

Soldier.—Head pale ferruginous, darkest towards the forehead; labrum pale ferruginous: basal joint of antennæ paler than labrum, rest of antennæ ochreous; jaws dark reddish-brown; thorax, legs, and abdomen whitish. Length, 3 mm. Head long, moderately slender, rounded behind, nearly straight on the sides,

rounded in front to the base of the jaws; forehead raised on the summit, sloping down to the clypeus. Clypeus large, arcuate behind, truncate in front, with a dark spot at either end. Labrum large, straight on the sides for one-half its length, then sloping to the bluntly pointed apex. Jaws long, slender, falcate, basal three-fourths of the cutting edge finely serrated. Antennæ 13-jointed, springing from circular clefts on the side of the head; 1st joint long, stout, slightly curved, swollen towards the apex; 2nd less than half the length, globose; 4th-11th moniliform; 12th longer; 13th elongate-oval; first three joints with few hairs, the rest moderately hairy. Prothorax small, not as wide as head, wider than long, anterior half bent upwards, front margin arcuate and slightly indented in the middle, sides convex and sloping to the deeply indented hind margin. Abdomen small, not as large as head; cerci small, cone-shaped, hairy; femora moderately stout; tibia slender, flattened; claws and spines small; fourth tarsal joint hairy towards the apex.

Worker.—Head pale ochreous; antennæ, thorax, and legs paler; rest of insect whitish. Length, 3 mm. Head moderately large, longer than broad, broadest behind the jaws, rounded behind, convex on the summit, forehead divided from posterior two thirds of the head by an indistinct suture (most noticeable in young specimens), arcuate behind the clypeus. Clypeus large, convex, apical one-fourth separated by a deep suture, basal three-fourths with few hairs, divided in the middle line by a suture, a large ferruginous spot at each end. Labrum large, broad behind, sloping to the truncate apex. Antennæ 13-jointed. Prothorax small, wider than long, similar to soldier. Abdomen long, slender, tapered at either end. Cerci small, cone-shaped. Legs as in soldier.

The type and cotype specimens were taken under a coconut lying on the ground, and in tunnels leading to it. Another small colony was found building a covered passage up the outside of a concrete house-pile in an endeavour to reach the floor-joists.

Hab.—Darwin, Northern Territory, (G. F. Hill, 28/1/14). Types (No.100) in the Entomologist's Office, Department of Agriculture, N.T.

TERMES GERMANA, sp.nov.

Winged form not known.

Soldier.—Head dark ochreous, jaws darker; thorax and legs pale yellow; rest of body yellowish-white. Length, 4mm. Head large, longer than broad, rounded behind, curved on the sides to the base of the jaws, widest across the middle, convex on the summit. Forehead hairy, slightly flattened and rugose, sloping down to the base of the clypeus. Clypeus large, flat, lobed in front, divided in the middle line by a deep suture; a small ferruginous spot at either end. Labrum long, convex, sloping on the sides to the rounded apex, reaching half way to the barb on either mandible, a few bristles on the apical half. Jaws large, curved, on either side about the middle a large, angular barb or fang directed backwards. Palpi long and slender, as long as jaws. Antennæ long, slender, 15-jointed, springing from circular protuberances on the sides of the head; 1st joint long, slightly swollen towards the apex, without hairs; 2nd one-half the length, slender, without hairs; 3rd one-half the length of 2nd; 4th and 5th moniliform; 6th to 14th oval, increasing in length; 15th elongate-oval; each joint from the 5th stalked and banded with white. Prothorax with a few long hairs, small, nearly as long as wide, divided across the middle by a deep suture, anterior half rounded and bent upwards, posterior half slightly convex, sloping on the sides to the rounded hind margin. Abdomen small, tapered to the extremity, hairy; cerci slender. Legs stout, 4th tarsal joint long, slender; claws slender; tibia armed with numerous spines in addition to the three apical spines.

Worker.—Head pale yellow; antennæ, legs and thorax lighter; rest of body white. Length, 3mm. Head orbiculate. Forehead slightly concave, arcuate behind the clypeus. Clypeus large, convex, truncate in front, with a brown spot at either end. Labrum large, broad behind, sloping on the sides to the truncate apex, barely hiding a large tooth near the tip of the left jaw. Antennæ 14-jointed. Prothorax small, similar to soldier. Abdomen moderately large, tapered rapidly to the extremity; cerci slender. Legs slender; tibial spines and claws small.

Only one small colony has come under the writer's notice. This was situated under a piece of wood lying upon the ground. The termites are believed to feed upon decaying grass-leaves.

Hab.—Fannie Bay, near Darwin, Northern Territory (G. F. Hill, 30/12/13). Types (No.119) in Entomologist's Office, Department of Agriculture, N.T.

TERMES RUBRICEPS Froggatt.

Proc. Linn. Soc. N. S. Wales, 1897, xxii., p.730.

Winged form [description incomplete].—General colour brown above, ochreous below. Head very dark brown. Ocelli pale yellow; base of clypeus light brown; antennæ lighter, and banded with whitish; thorax and apex of each dorsal plate of abdomen brown; rest of insect dark ochreous. Head large, rounded, slightly longer than wide. Forehead concave, with a deep circular cleft in the centre, a distinct suture from the cleft to the posterior margin of the head, arcuate behind the clypeus, summit without hairs. Eyes large, finely faceted, projecting. Ocelli large, circular, in line with the front margin of the eyes, from which they are widely separated. Between the ocelli and clypeus, a large light brown spot. Antennæ 18-jointed, springing from a circular cleft in front of, and close to, the eye; 1st joint moderately long, cylindrical, apex whitish and fringed with hairs; 3rd and 4th very small, coalesced; 5th to 7th moniliform; 8th to 17th stalked, straight on the sides; 18th elongate; 5th to 18th covered with fine short hairs, and a few long ones. Clypeus large, convex, divided by a suture, apex lobed. Labrum large, convex, widest across the middle, sloping to the blunt apex. Prothorax saddle-shaped, not as wide as head, wider than long, truncate in front, rounded on the sides and hind margin, front margin bent up in the middle and crossed by a suture; behind the suture, the summit is concave. Scapular shield showing the base of five nervures; cross-suture transverse. Abdomen nearly cylindrical, bluntly rounded at the end. Cerci very small. Abdomen and thorax covered with short hairs. Legs long, stout, hairy; tibial spines strong; claws long and slender. [Wings damaged].

The foregoing description refers to a single damaged specimen taken in an underground passage (11/1/14) in which were found

numerous soldiers and workers. A portion of two wings only remained. Considering the proximity of these insects to the writer's house, the fact that lights were burning nightly only a few yards distant, and that occupied passages were examined frequently throughout the wet season, it is remarkable that numbers of winged insects were not secured.

Termes rubriceps is not known to build termitaria, although the insects are frequently taken in the walls of termitaria built by *Coptotermes acinaciformis*, at the base of termitaria built by *Eutermes triodiae*, and in abandoned nests of doubtful identity. In such situations, the colonies are small, and consist of workers and soldiers, which live upon the food stored by their hosts or upon rejectamenta.

Their real homes are in rambling, underground galleries and chambers, situated on well-drained, pebbly or stony country. They are largely grass-feeders, and, as such, can hardly be regarded as pests. Small grassless or thinly grassed patches are generally characteristic of the land tunnelled by these termites. One may see, in such places, hundreds of workers and soldiers streaming out of small openings, measuring about 6 mm. by 3 mm., and dividing into parties or scattering. In a few minutes, the workers begin to return, each with a short piece of grass (green or dry), a grass-seed, a piece of Eucalypt-leaf or other vegetable matter; and, before long, there is a constant stream backward and forward. In this work, the soldiers direct operations, and defend the workers from predaceous ants. When sufficient food has been collected, or when disturbed, all return, and the openings, from which they came, are quickly sealed up with saliva-moistened earth. As a rule, operations are carried on simultaneously from several openings, sometimes as many as twelve, over an area of 20 to 30 feet or more. Some of the openings are provided with projecting lips, but, as a rule, they are flush with the ground, faced with cemented particles of earth, and sealed just below the level of the ground.

Although generally nocturnal in their habits, they are very often found gathering their food in the full glare of sunlight. Stores are collected at frequent intervals throughout the year.

Just below the surface, and opening off the tunnel used as an exit, there is an elongate, oval chamber which, like similar ones deeper down, will be found, after harvesting operations, to be full of short lengths of grass, etc. The lower chambers are generally larger than those near the surface, but all are very irregular in size and shape, varying, in the lower ones, from 6 to 10 mm., from floor to roof, and from 30 to 60 mm. across. The passages connecting them are greatly constricted for a short distance, and neither the passages nor the chambers are coated with alimentary rejectamenta, such as is to be found in the tunnels of *Mastotermes*. Certain chambers, either near the surface or deeper down, are used for the reception of waste-products, and such portions of the dead as are not used for food. Most of the chambers are from $1\frac{1}{2}$ to 6 inches below the surface, rarely are they deeper than 12 inches. There appears to be no regular "nursery." The eggs are carried by the workers to any of the large flat chambers, and there deposited in little heaps. Larvæ and nymphs are found in all the passages and galleries.

The eggs are yellowish-white, semitransparent, convex on one side, concave on the other, and bluntly rounded at the ends. They measure 0.03 in length by 0.01 mm. in width, and have been taken in December, January, and February.

Loc.—Darwin, Stapleton, Brock's Creek, N.T.

TERMES TURNERI, Froggatt.

Froggatt, *op. cit.*, 1897, p.736.

This would appear to be an uncommon species in the northern portion of the Territory, since only two small communities have come under the writer's notice.

The first was taken at Stapleton (31/12/12) in a few small galleries in the basal portion of the wall of a termitarium of *Coptotermes acinaciformis*, and comprised a few soldiers, workers, and winged forms. The queen was probably destroyed or lost in the fall of earth. The second community was taken a few days later, in the same locality, in portion of a deserted termitarium of *Termes* sp., near *ferox*. In both cases, the winged forms greatly outnumbered the workers and soldiers.

COPTOTERMES ACINACIFORMIS Froggatt. (Plates xiv.-xviii.)

Termes acinaciformis Froggatt, *op. cit.*, 1897, p.740.

This is, probably, the commonest species in the northern part of the Territory, where they are responsible for most of the damage to growing forest-trees. Hollow Ironwood-trees (*Pithecolobium moniliferum*) and Eucalypts are almost invariably infested with them, but they are rarely found in fence-posts or in buildings constructed of indigenous or imported timbers.

The large, dome-shaped termitaria (Plate xiv.), typical of the species, are usually found on well-drained, open forest country at the base of a tree, or enveloping a stump (Plate xv.). They are rarely found on wet lands or on hill-sides. Few attain a height of more than four or five feet, but occasionally one sees a straight column, six to eight feet high, surmounting one of these dome-shaped mounds. These columns are formed as the tree-trunks are gradually converted into food, and finally replaced by a column of earth and triturated wood. In most cases, trees appear to be attacked from below ground, and hollowed out to a considerable height before any external evidence of the presence of termites can be detected. Sometimes destruction is not carried beyond this stage, and excellent fencing timber is obtained from such trees, especially from *Eucalyptus miniata*, a timber that possesses considerable termite-resisting properties when used for fences, stock-yards, etc. More often, however, destruction continues, and the characteristic termitaria are built, and gradually extended, until the weakened trunk is blown over or consumed. Isolated mounds are common, and, if opened, will be found to contain, as a rule, some portion of a tree or stump (Plate xvi.). What occurs, when this portion is consumed, is not known, but there is evidence, in the shrivelled condition of the queens' abdomina, in the small number of soldiers and workers often observed, and in the number of abandoned and ruined termitaria, to suggest that the community dies out gradually as the food-supply diminishes.

The walls of the termitaria are constructed of fine particles of earth and sand, gathered on the surface of the ground, and firmly cemented together into an intensely hard mass. The

foundations rest upon the surface, and are often used as the homes of other termites (*T. rubriceps*, *T. Turneri*, and *Eutermes* spp.), and of true ants (*Opisthopsis respiciens*, *Camponotus Novæ-Hollandiæ*, and *Iridomyrmex detectus*). The thickness of the walls varies, even in the same termitarium, from two inches near the summit, to twelve inches near the ground, or on the sides. A few irregular, winding passages traverse the walls, and, in them, may be found a few soldiers and workers. The interior is composed of triturated wood moulded into curious forms. The upper portion is open and easily broken, but lower down it is more solid, lumpy, and folded. Near the ground, towards the middle of the nest, this papiermaché-like material is in thin layers, forming more or less horizontal chambers. This is the "nursery." It contains the queen, eggs, larvæ, nymphæ, and a few soldiers and workers. The queen is generally found about three inches from the ground, and about the middle of the nest, in a low domed cell with more or less level floor, from which she cannot escape. The eggs are removed by the workers, as soon as they are laid, to surrounding cells, and the young are reared still further from the queen.

The interior is generally separated from the walls by a space varying from $\frac{1}{4}$ inch to 3 inches, and is connected, in certain parts, by threads or a network of finely drawn out composition. In termitaria having no portion of a stump or tree within their walls, the woody interior rests upon a concave surface of earthy material, pierced by a few small passages. The lower portion of the interior is fairly dry, but the summit is moist and viscous.

In the Stapleton district, where the predominant termitaria are those of *Eutermes triodiæ*, there are many abandoned mounds, apparently of that species, on the heavy grey-soil flats at the foot of the hills. In breaking these down, one occasionally finds large nests of *Coptotermes acinaciformis* built within them, and resting on a foundation of solid earthy material, twenty to thirty inches thick, penetrated by a few passages into the surrounding soil (Plates xvii.-xviii.).

The occurrence of a male in the queen's cell is very rare indeed. Complementary queens have not been found by the writer, but

it is probable that they are used, since several termitaria, from which queens were removed, were immediately repaired, and have since been increased to their original size.

A fully-developed gravid queen measures about 18 mm. in length, by 6 mm. in width at the widest part of the abdomen.

Winged swarms leave the termitaria in December and January, but a few winged insects may be found in them months later.

When disturbed, the soldiers eject a small quantity of milky secretion from a circular opening above the jaws, a habit that at once distinguishes them from other local species.

This species is not infrequently met with in company with *Rhinotermes reticulatus*, but, unlike *Rhinotermes*, they are rarely found in buildings, and never (to the writer's knowledge) in cultivated plants.

Loc.—Darwin, Stapleton, Melville Island, Bathurst Island.

COPRITERMES MELVILLENSIS, sp.nov.

Winged form not known.

Soldier.—Head yellow, thorax, antennæ, and legs paler, the apex of each antennal segment banded with white; jaws dark castaneous; rest of insect whitish. Length, $3\frac{1}{2}$ mm. exclusive of jaws; jaws $1\frac{1}{4}$ mm. Head long, slender, cylindrical, bluntly rounded behind, straight on the sides to near the truncate front. Forehead produced into a cone-shaped projection, which is directed slightly upwards, and extends as far forward as the apex of the labrum, bearing a wart-like protuberance on either side between the base and the antennal cleft. Clypeus small, rounded in front. Labrum long, nearly straight on the sides, truncate at the apex, with either side produced into a slender point, anterior half with a patch of ochreous and scattered hairs, the rest white. Antennæ long, stout, hairy, 14-jointed, springing from a circular protuberance situated within a deep angular depression in front of the head; 1st joint long, stout, cylindrical; 2nd one-half the diameter and length; 3rd and 4th smallest, moniliform; 5th to 13th increasing in length, turbinate; 14th elongate. Jaws very long, longer than head, similar to *Copri-termes Froggatti*, and *C. Taylora*. Prothorax small, not as wide

as head, divided across the middle by a deep depression, the apical half rounded in front, and turned up like a collar, the sides curving round to the hind margin, which is slightly indented. Abdomen elongate-oval, round in section; cerci large, hairy, pale ferruginous in colour, and conspicuous against the whitish body. Claws and tibial spines stout.

Worker.—Head pale yellow; thorax, legs, and antennæ lighter; the rest of the insect whitish. Length, $3\frac{1}{3}$ mm. Head large, round. Clypeus large, convex, lobed, a dark spot at each end. Labrum large, widest in the middle, contracted towards the truncate apex. Prothorax narrow, divided by a deep depression, apical half rounded, and turned up like a collar, hind margin rounded. Abdomen elongate-oval. Legs stout; claws and spines small; cerci large.

The type and cotype specimens were taken from a small termitarium composed of a blackish-coloured composition of triturerated wood and earth, built against the trunk of a living Eucalypt-tree.

In common with allied species, both the soldiers and workers are timid, and make no effort to defend themselves when disturbed. The soldiers produce a sharp, snapping sound with the jaws, which are normally carried horizontally, and meet only at the tips. In dead specimens, the jaws are almost invariably depressed, and crossed at the base.

Excepting in the paler colour of the head (soldier), this species does not differ from a mainland-form taken in company with a smaller termite (*T. nana*) in a blackish-coloured mass of triturerated wood and earth, within a cluster of bamboos growing in the Botanic Gardens, Darwin.

Hab.—Fort Dundas, Melville Island, Northern Territory (G. F. Hill, 12/4/14). Type (No.115) in the Entomologist's Office, Department of Agriculture, N.T.

COPRITERMES TAYLORI, sp.nov.

Winged form not known.

Neoteinic queen.—Head, thorax, and chitinous plates of abdomen light yellow; legs and antennæ paler; rest of body creamy-

white. Length, 5 mm. Head rounded behind; forehead concave; eyes circular, projecting from the sides of the head, finely faceted; ocelli round, in line with the front margin of the eyes; clypeus large, convex, arcuate behind, rounded on the side, divided longitudinally by a suture which extends across the concave forehead, front margin rounded, depressed, divided from the posterior portion by a deep lateral suture. Labrum large, projecting beyond the jaws, broadest behind, narrowing to the bluntly pointed apex. Antennæ hairy, 15-jointed, short, slender, springing from a circular cleft in front of the eyes; 1st joint long, slightly turbinate; 2nd one-half the length of first, cylindrical; 3rd very small; 4th to 10th larger, coalesced; 11th, 12th, 13th increasing in size; 14th longer, nearly cylindrical; 15th elongate-oval, slightly stalked, longer than 14th. Prothorax long, narrower than head, saddle-shaped, truncate and rigid in front, sides and hind margin rounded; wing-pads rudimentary. Tarsi slender, claws small. Cerci small, cone-shaped. Entire head, thorax, abdomen, and legs covered with fine pale hairs.

Male (king).—General colour dark brown above; head castaneous; antennæ dark brown, with the base and apex of each segment whitish; legs and chitinous plates of ventral surface light brown. Length, $3\frac{1}{2}$ mm. Head rounded behind, flattened on the summit, sloping down to the prominent clypeus, with a curious keyhole-like whitish mark in the depressed centre in line with the middle of the eyes. Eyes large, prominent, projecting well beyond the genæ. Ocelli large, reniform, adjacent to the inner margin of the eyes. Antennæ hairy, 15-jointed, springing from circular clefts in front of the eyes; 1st joint long, stout, cylindrical; 2nd one-half as long; 3rd very small; 4th-10th moniliform; 11th-14th increasing in length; 13th and 14th nearly cylindrical; 15th largest, elongate-oval. Clypeus paler than head, large, convex, arcuate behind, rounded on the sides; apex whitish, rounded in front, divided from the basal two-thirds by a deep transverse suture. Labrum large, covering the jaws, narrow at the base, swelling out at the sides beyond the middle, and contracting again to the rounded apex. Prothorax long, rugose, narrower than head, truncate and slightly bent in front;

sides and posterior margin rounded. Scapular shield angular; cross-suture transverse. Thighs stout, flattened; tibia slender; apical spines and claws large. Cerci small, cone-shaped.

Soldier.—Head pale yellow, antennæ with the base and apex of each segment white-banded; jaws dark castaneous; rest of insect dull white. Length, $2\frac{2}{3}$ mm., exclusive of jaws; jaws 1 mm. Head long, slender, cylindrical, rounded behind, sides straight to near the antennal clefts, truncate in front, with the forehead produced into a long cone-shaped projection directed slightly upwards, and extending as far forward as the apex of the labrum. Clypeus small, rounded in front, whitish in colour. Labrum long, very slightly contracted towards the apex, which is produced into a sharp point at either side and bears a few long hairs. Antennæ long, slender, hairy, 14-jointed, springing from circular clefts within angular depressions on the side of the head; 1st joint long, stout, nearly cylindrical; 2nd one-half the length of the 1st, slender; 3rd and 4th small, moniliform; 5th 13th increasing in length, slightly turbinate; 14th longer than 13th, elongate-oval. Jaws very long, longer than head, curved, slender, springing from the centre of the head, curved downwards to near the tips, which are straighter and flattened on one side. At the base of the left jaw, there is a large blunt fang opposed to a blunted projection on the right. Prothorax small, not as wide as head, the apical half rounded in front, and turned up nearly at right angles, the sides sloping back to the hind margin, which is slightly indented in the middle. Abdomen elongate-oval, rounded in section. Femora flattened. Tibia long, slender, with small apical spines and large claws. Cerci small, hairy.

Worker.—Head and antennæ paler than soldier, with ferruginous spots on either end of the clypeus. Head large, rounded, more hairy than that of the soldier. Clypeus large, convex, rounded behind, lobed. Labrum large, rounded in front. Antennæ 14-jointed, hairy, 3rd and 4th joints smallest. Legs stout; tibial spines small; claws large. Cerci small, hairy. The posterior opening always appears to be distended, as in the soldiers. Length, 3 mm.

Eggs.—Pale yellow, curved, bluntly rounded at the ends, $\frac{1}{2}$ mm. in length.

This species appears to be a rare one, only one community having come under the writer's notice up to the present time. This colony consisted of a gravid neoteinic queen, king, two complementary queens, about 15 soldiers, about 100 workers, numerous nymphæ and eggs. The nest was a rounded mass, about 3 inches in diameter, composed of triturated wood and earth, situated just below the surface of the ground at the base of a fencepost-strutt. The royal pair were found in a small gallery, not differentiated from other galleries, with a few soldiers and workers. The eggs were stored in similar galleries close by. One of the complementary queens occupied a small passage about one inch distant, and by her were numerous eggs, and a few soldiers and workers. The species is of little economic importance.

I have pleasure in naming the species after Mr. Frank H. Taylor, Entomologist to the Australian Institute of Tropical Medicine, Queensland.

Hab.—Koolpinyah, near Darwin, Northern Territory (G. F. Hill, 21/11/13). Types (No. 89) in Entomologist's Office, Department of Agriculture, N.T.

COPRITERMES FROGGATTI, sp. nov.

Winged form not known.

Queen.—Head and marking on scapular shield ferruginous; clypeus, antennæ, thorax, legs, and chitinous plates of abdomen paler; rest of body whitish. Length, 10 mm. Head hairy like prothorax, rounded behind, flattened on summit, a keyhole-like mark in the centre, in line with the centre of the eyes. Eyes large, projecting well beyond the sides of the head; ocelli large, reniform. Antennæ hairy, base and apex of each segment white, 13-jointed, springing from a circular cleft in front of the eyes; 1st joint long and fairly stout; 2nd much shorter; 3rd smallest, circular; 4th and 5th moniliform; 6th-12th increasing in length, slightly turbinate; 13th same length as 12th. Clypeus large, arcuate behind, divided in the middle line by an indistinct suture, apex depressed, divided from the basal three-fourths by a deep cross-suture, sides sloping to the truncate front margin.

Labrum large, convex, broad at the base, spade-shaped at the apex, not reaching the tip of the stout jaws. Prothorax saddle-shaped, truncate and slightly raised in front, rounded behind, divided in the middle line by a narrow suture; on the summit, an irregular raised area one-half the width of the prothorax, with depressed centre. Scapular shield hairy, showing the base of four main nervures very distinctly; cross-suture nearly transverse. Abdomen long, cylindrical, bluntly rounded at the end; chitinous plates hairy; cerci indistinct.

Soldier.—Head dark ochreous; antennæ ochreous, with the base and apex of each segment white; jaws dark castaneous; rest of insect whitish. Length, $3\frac{1}{4}$ mm., exclusive of jaws; jaws 1 mm. Head a little longer than broad, bluntly rounded behind, sides straight to the base of a sharp projection from an irregular, roughened protuberance below the antennal cleft, truncate in front, with the forehead produced into a long, hairy, cone-shaped projection bearing a smaller projection on either side at the base, directed slightly upwards, and extending as far forward as the apex of the labrum. Clypeus indistinct. Labrum long, with the nearly straight sides produced into a point at either side, the front margin between the points slightly convex, scattered reddish hairs on the upper anterior portion. [In one of the co-types the labrum is slightly contracted on the sides, and truncate in front.] Antennæ hairy, 14-jointed, springing from slightly raised tubercles in front of the head, and below the two smaller projections of the forehead; first joint long, stout, nearly cylindrical; 2nd less than one-half the length, slender; 3rd and 4th smallest; 5th-13th long, slightly turbinate; 14th longer than 13th, elongate-oval. Jaws very long, longer than head, slender, curved, springing from the centre of the head, tips flattened on one side and sharply curved downwards, with a large blunt fang at the base of the left jaw, opposed to an irregular blunted projection on the right. Prothorax small, about one-half the width of the head, divided in the middle line by an indistinct suture, the middle of the apical half turned up nearly at right angles like a collar, front margin rounded, notched in the middle, hind margin rounded. Abdomen elongate-oval,

round in section; cerci small; claws strong; tibial spines larger than in *H. Taylora*.

Worker.—Head pale yellow; thorax and antennæ lighter; rest of insect whitish. Length, $3\frac{1}{4}$ mm. Head small, rounded behind and on the sides, with an obscure keyhole-like mark in the centre of the slightly flattened forehead. Clypeus large, convex, rounded, divided in the middle line by an obscure suture, front margin truncate, apex divided from hind portion by a deep suture, a brown spot at either end of the clypeus in line with the antennal clefts. Labrum large, hairy, not covering jaws, broad at the base, sloping in to the truncate apex. Antennæ short, 14-jointed, arising from small protuberances; 1st joint long, slender; 2nd one-half the length; 3rd and 4th small, coalesced; 5th larger; 6th to 13th moniliform; 14th long. Prothorax small, hairy, rounded behind, apical half turned up nearly at right angles. Legs small, slender. Abdomen elongate-oval; cerci very small.

This appears to be a rare species, only one small colony having been taken. The queen, with three soldiers and about fifty workers and nymphæ, were taken at ground-level in an abandoned termitarium of *Eutermes hastilis*. It is a very distinct species, easily distinguished from others of this group.

I have much pleasure in dedicating this species to Mr. W. W. Froggatt, Government Entomologist of New South Wales, who has kindly identified many termites for me, and whose works on the Termitidæ I have freely consulted.

Hab.—Thirty-four miles east of Darwin, Northern Territory (G. F. Hill, 14/1/13). Types (No.34) in Entomologist's Office, Department of Agriculture, N.T.

EUTERMES PASTINATOR, sp.nov. (Plates xix.)

Winged form.—Head nearly black, antennæ, clypeus, labrum, palpi, legs, and underparts dull ochreous; thorax, chitinous plates of dorsum of abdomen, and a spot at either end of plates 2-6 of ventral surface, dark brown. Length, to tip of wings, 20.5 mm.; to tip of body, 10 mm. Head very hairy, round behind, a narrow cleft in the depressed centre of the flattened summit, arcuate behind the clypeus; eyes large, round, projecting; ocelli large,

oval. Antennæ 16-jointed, hairy, springing from a circular cleft in front of the eyes; 1st joint long, stout, cylindrical; 2nd and 3rd smaller, slightly turbinate, with few hairs; 4th short, hairy; 5th to 15th longer, turbinate, becoming more slender and stalked towards the tip; 16th slender, elongate-oval. Clypeus large, broad, convex, with an indistinct median suture, lobed in front. Labrum narrow at the base, swelling out on the sides, rounded in front. Palpi stout, hairy. Jaws large, stout; right mandible with two, sharp, angular, stout teeth at apex, followed by a much shorter and blunter one, and a large serrated basal tooth; left mandible with two, sharp apical teeth, the hindermost connected with a third and smaller pointed one by a long cutting edge; at the base of the mandible there is a large, irregular, blunt tooth opposed to the serrated tooth on the right. Prothorax hairy, wider than long, narrower than head, with median suture, straight along the front margin, rounded on the sides and hind margin, front margin slightly bent up in the centre. Scapular shields hairy, rugose; cross-suture transverse. Wings large (forewing $15\frac{1}{3}$ mm. long, by $4\frac{1}{2}$ mm. in width; hindwing $14\frac{2}{3}$ mm. long, by $4\frac{1}{2}$ mm. in width), rounded at the tips, base of the costal and below subcostal nervures yellow, rest of wings smoky. Forewing, costal and subcostal nervures stout, running close together and nearly parallel to the tip of the wing; median nervure running through upper half of the wing for two-thirds of its length, with three simple nervelets, the first two of which are long and slender; submedian nervure slender, parallel to the median to a little beyond the first branch in the latter, then curving downwards to the hind margin, with eleven simple, oblique nervures, the first five of which are very stout. Hindwing similar to forewing, excepting that there is usually one less oblique nervure from the submedian. Legs strong, hairy; claws and tibial spines long and slender. Abdomen large, elongate-oval, bluntly rounded at the tip, covered with fine hairs; cerci short, cone-shaped, hairy.

Queen. — General colour creamy-white; chitinous plates dark brown, fringed on the hind margin with fine hairs; connecting membrane glabrous. Total length, 25 mm.; diameter of abdomen, 8 mm.

Soldier.—Head rusty-brown, base of snout darker, back of head distinctly lighter, rest of insect ochreous-yellow. Length, $3\frac{1}{3}$ mm. Head round behind, tapered to the base of the snout, a cluster of fine hairs and bristles on tip of snout; scattered, long, slender, reddish bristles on rest of head. Palpi long, slender, very hairy, reaching tip of snout. Antennæ 14-jointed, very long and slender, the base of segments 2-6 whitish; 1st segment long, moderately stout, nearly cylindrical, without hairs; 2nd and 3rd less than one-half the length, slender; 4th to 10th increasing in length, slightly swollen towards the apex; 11th to 14th decreasing in length. Prothorax small, not as wide as head, much wider than long, rounded in front and behind, anterior half bent up in the middle, and fringed with a few long hairs. Hind margin of pro-, meso-, and metathorax fringed similarly. Legs very long; femora cylindrical, sharply contracted at the base, with a few fine hairs; tibia long, hairy; spines small; claws long and slender. Abdomen small, covered with scattered hairs; cerci long, slender, with a few long hairs at apex.

Worker.—Head pale ferruginous above; clypeus, thorax, and legs very pale ochreous; rest of insect whitish. Length, $5\frac{1}{2}$ mm. Head rounded behind, broadest across the middle, arcuate behind the clypeus, a pale median suture joining another which crosses the head well behind the clypeus, a dark ferruginous spot at either end of the clypeus. Clypeus large, convex, divided by a median suture, lobed in front, apex bluntly pointed. Labrum large, narrowest at the base, swelling out on the sides, rounded in front. Jaws short, not as stout as, but otherwise similar to, those of winged forms. Antennæ 16-jointed. Legs moderately short and stout; tibial spines small; claws moderately long and slender. Abdomen large, covered with fine scattered hairs; cerci large, hairy.

The termitaria of *E. pastinator* are enveloped in an intensely hard exterior wall, composed of fine particles of earth, sand, and short lengths of grass firmly cemented together. Few exceed 2 ft. in height, by 2 ft. 9 in. in diameter at the base, the average being about 1 ft. 6 in. in height, by about 2 ft. in diameter. In shape, they are flattened domes, with or without irregular pro-

jections of the sides and summit, but all are sufficiently alike to distinguish them from the nests of other local species (Plate xix.).

The interior is composed of similar material, and is not separable from the walls. A labyrinth of passages traverses it in all directions, those near the base being larger and more flattened than the others. There is no well-defined "nursery," and the position of the queen-cell varies greatly in individual nests. Sometimes it is situated near the side, and about one inch below the level of the surrounding surface-soil; at others, it is well down below ground-level, and beneath the middle of the superstructure. The cell measures about 3 inches in diameter, by $\frac{1}{2}$ inch in height; with irregular floor, and the sides pierced by three or four holes large enough to admit the soldiers and workers.

The exterior walls rest upon the natural surface of the soil, and are largely, if not entirely, constructed of material mined from below, with a small admixture of short lengths of grass to bind the particles. Below the superstructure, there is an area, roughly corresponding to the size of the dome, which is traversed by innumerable passages. These passages contain a quantity of grass cut into lengths of about $\frac{1}{3}$ of an inch, but the greater part of the underground space is occupied by the young and adults. The main store of grass, upon which they live, is stored in the superstructure. Foraging tunnels pass out beneath the walls into the surrounding soil, and, from them, the workers and soldiers reach the surface to gather food.

The termitaria are found on high, well-drained situations, either on light gravelly loam, or on stony hill-sides. In the latter situations, the underground portions of the nests are restricted or rambling, as a matter of course, according to the nature and quantity of stone underlying the superstructure. Accretions to the outer walls (Pl. xix., fig. 7) are made during the dry season. In two nests kept under close observation at Koolpinyah, in May, this work was carried on during alternate nights, between the hours of 8 p.m. and 8 a.m. Supplementary queens are unknown.

Termitophilous insects, other than *Mastotermes darwiniensis*, have not been recorded from these nests, nor are the latter invaded by predaceous ants.

Hab.—Thirty-four-mile Siding, Northern Territory Railway (G. F. Hill, 14/11/13); Darwin, Koolpinyah, Stapleton. Types (No.28) in Entomologist's Office, Department of Agriculture, N.T.

EUTERMES LONGIPENNIS, nov.sp.

Winged form.—Upper surface of head castaneous; mouth-parts ochreous; antennæ dark ochreous, the apex of each segment paler; thorax and scapular shields ferruginous; dorsal plates of abdomen dark brown, ventral plates with a light brown spot at each end; the rest of insect ochreous. Length, to tip of wings, 20 mm.; to tip of body, 10 mm. Head very hairy, rounded behind, broadest across the eyes, sloping in to the base of the clypeus, flattened on the summit, and divided by an obscure median suture, which merges into a forked cleft in line with the centre of the eyes; eyes moderately large, projecting, finely faceted; ocelli oval, adjacent to the inner margin of the eyes. Antennæ 16-jointed, stout, hairy, springing from a circular cleft in front of the eyes; 1st joint long, slightly turbinate; 2nd less than one-half the length, and slightly swollen at the apex; 3rd about the same length as the 2nd, stalked; 4th very short, more rounded; 5th-7th larger, rounded; 8th-15th elongate, stalked, swollen towards the apex; 16th shorter, elongate-oval. Clypeus moderately large, hairy, slightly arcuate behind, lobed in front, apex paler in colour, and bluntly pointed. Labrum narrow at the base, swelling out on the sides, rounded in front, covering the tips of the jaws. Jaws large, right mandible with two, sharp, stout, angular teeth at the apex, followed by a much shorter and blunted one, and a large, serrated basal tooth; left mandible with two, sharp, apical teeth, the hindermost connected with a third and smaller one by a long cutting edge; at the base of the jaw, a large, irregular, blunt tooth opposed to the serrated tooth on the right. Prothorax hairy, broad, not as wide as head, middle of front margin bent-up, sides sloping round to the hind margin, which is nearly straight, a deep depression behind the

bent-up front margin on either side of the median line. Scapular shields hairy, small; cross-suture transverse. Wings very large (forewing 27 mm. in length, by $4\frac{1}{2}$ mm. in width; hindwing $16\frac{1}{4}$ mm. in length, by 5 mm. in width), below the base of the costal and the entire length of the subcostal nervures deep yellow, giving the front margin of the wing a conspicuous tinge of colour; oblique nervures dark brown, the rest of wing dull ochreous. Forewing: costal and subcostal nervures stout, running nearly parallel to the apex; median nervure running through the upper half of the wing, slender, number and position of nervelets very variable, and rarely alike in the same pair of wings; submedian nervure slender, running through the middle of the wing for about one-half its length, number of oblique nervures variable (9 to 12), most or all of which are very stout, simple or bifurcated, rarely alike in the same pair of wings. Hindwing: costal and subcostal nervures similar to forewing, median nervure stouter than in forewing, with several short, oblique nervelets running towards the subcostal, the number, form, and position of the main branches very variable, and usually differing in the same pair of wings; submedian nervure as stout as median, oblique nervures very stout and variable as to number and form, and often differing greatly in the same pair of wings. Legs strong, hairy, inner margin of tibiæ fringed with numerous bristles; tibial spines and claws long. Abdomen nearly cylindrical, broadly rounded at the tip, covered with fine golden pubescence; cerci short, hairy.

Soldier. — Head reddish-brown; thorax and antennæ brownish-yellow, base and apex of each antennal segment, from the second to seventh, white-banded; legs and rest of insect stramineous. Length, $3\frac{1}{2}$ mm. Head large, rounded behind and on the sides, sloping abruptly to the base of the snout (head wider, and more rounded than in *E. pastinator*), a few fine hairs on tip of the snout, and long, scattered bristles on the rest of the head. Antennæ 14-jointed, moderately long; 1st joint moderately long, stout, nearly cylindrical, with a few hairs; 2nd less than one-half the length and width, nearly cylindrical, with a few short hairs; 3rd shorter than 2nd, more hirsute; 4th to 6th about the same

length as 2nd, hairy, swollen towards the apices; 7th-13th longer, hairy, stalked; 14th shorter, elongate-oval. Prothorax small, not as wide as head, much wider than long, rounded in front and behind, anterior half bent-up in the middle, and fringed with a few, long, reddish hairs; hind margin of pro-, meso-, and metathorax similarly fringed. Abdomen small, covered with stout, red hairs; cerci long, slender, hairy. Legs short, moderately stout, with a few hairs; tibial spines small; claws very small.

Worker.—Head brown above; rest of head and thorax pale ochreous; legs much paler; abdomen whitish. Length, 4 mm. Head slightly longer than wide, rounded behind, arcuate behind the clypeus, a pale median suture dividing the head, and joining another irregular one, which crosses the forehead well behind the clypeus. Clypeus very large, broadly lobed, divided by a median suture, a dark spot at either end, posterior lobe convex, anterior lobe whitish, with a yellow mark on either side of the middle, front margin slightly arcuate. Labrum large, convex, narrow at the base, spreading out in the middle, rounded in front. Jaws short, not as stout as in the winged form, but otherwise similar. Antennæ 15-jointed. Abdomen large; cerci slender, with a few hairs. Legs short, stout, with scattered reddish hairs; tibial spines small; claws long.

Further research will probably prove this to be a fairly common species in the locality from which the types and cotypes were taken. Termitaria similar to those described below were not infrequently noticed, but they were taken to be those of an undetermined species of *Eutermes*. That there were two species in the same locality, building outwardly similar termitaria, was not discovered until recently.

The termitarium from which the types were taken, measured 24 inches in height, by 16 inches in diameter at the base, with sides tapered evenly to the bluntly pointed apex. The walls were built of the same material as the interior, *i.e.*, a composition of triturated wood and fine particles of earth, and were not separable from the inner portion. The outer part of the mass was dense and nearly solid, but, towards the centre, it was

traversed by many passages and flattened galleries (the latter mostly near the base, and evidently forming the "nursery"). The base rested partly on the sandy surface of the soil, and partly on a dead stump (*Eugenia*), now eaten away to the ground-level. The nest contained a great number of matured winged forms and many soldiers, but few workers and eggs. Unfortunately, owing to the lateness of the hour, and the fact that the species was not recognised as being distinct from others previously investigated, no special effort was made to secure the queen. A second and similar termitarium was found over the remnant of a Eucalypt-tree (at Koolpinyah, 30/5/13). In this case, the interior contained a quantity of larval excrement of the Cetonid beetle, *Hemipharis insularis*, the pellets being either loose or cemented together in masses in the lower galleries. Numerous *Hemipharis* larvæ and pupæ were found near the remaining underground portion of the stump.

Hab.—Koolpinyah, Northern Territory (G. F. Hill, 21/11/13). Types (No.87) in Entomologist's Office, Department of Agriculture, N.T.

EUTERMES TRIODLE Froggatt. (Plates xx.-xxiii.)

Froggatt, *op. cit.*, 1897, p.745.

Travellers on the Darwin-Pine Creek Railway are familiar with the great termitaria of the Spinifex Termite, and many writers have referred to them in past years.

The mounds, or termitaria, are found on almost all kinds of soils, and in various situations, but rarely, in the Territory at any rate, on black peaty soils or on rocky hill-sides. They are commonly found on sour, stiff, grey soil or sandy flats, on timbered or treeless land, on dry gravelly or scrubby country, and in the little gullies amongst the low sandstone ridges (Plates xx.-xxiii.).

The starting-point of a termitarium is invariably a tussock of coarse grass, never a stump, tree, or log. They vary considerably in size, shape, and relative density, but all are constructed entirely of fine particles of earth and sand, cemented together with proctodæal and salivary products. The interior is a maze of irregular chambers and passages, which are, in most cases,

tightly packed with short lengths of grass. In small, recently constructed mounds, the outer walls and interior partitions are very thin and easily broken, but, in the older and larger ones, only the recently-added buttresses are fragile. The interior and older buttresses are so strengthened, and the passages so cemented up, that it is difficult to make any impression upon them, even with a sharp pick. The writer has not made an investigation of the interior of these giant mounds, but many of the smaller ones, up to eight or nine feet in height, have been examined. In every case, the interior was not sheathed in an enveloping wall, such as exists in the termitaria of *Coptotermes*, but the structure and composition was similar throughout.

The food consists of dry grass only, the principal stores of which are found towards the outer walls from the ground to the summit. Many of the galleries and passages, especially in the upper middle portion, are frequently entirely filled with earthy material and rejectamenta cemented into a solid mass. The queen-cell is situated in the middle, and about six inches from the ground. Above and below the queen-cell, the structure is more open and laminated, and contains the eggs and larvæ. Adult males have not been found with the queens, nor have complementary queens been discovered.

The whole structure rests upon the natural surface of the ground, and a number of tunnels pass out under the walls into the surrounding soil. These tunnels are flattened (averaging about 5 mm., by 20-50 mm.) and lie obliquely to the surface, presumably to facilitate the carrying of comparatively long pieces of grass along them to the termitarium. When stores of grass are to be gathered, openings are cut through the intervening soil to the surface, and the soldiers and workers pour out in all directions. The tunnels lie a few inches under the surface, and extend outward from the mound for some considerable distance (44 feet in one instance). The food is gathered quickly by the workers, carried to the openings, and thence underground to the termitarium. The tunnels are kept in repair, and are occupied throughout the year. Harvesting is done in the dry season, and at night or early in the morning.

The soldiers are very numerous and pugnacious. If a portion of the mound is damaged, they quickly cluster about the breach to protect the workers while repairs are being effected. The mouth-parts are not adapted for biting, but, from the tip of the snout, they eject a clear, honey-like fluid, which appears to possess caustic properties, besides impeding the actions of attacking predaceous ants. This secretion does not appear on the snout as a drop, but leaves it in a fine jet, which has the appearance of a silken thread waving from the tip. In defence, the *Eutermes* are more formidable than any of the apparently better-armed *Termes*. Even powerful ants, such as *Odontomachus ruficeps*, are sometimes driven off by the little *Eutermes*.

There is no evidence to support the assertion that the termitaria are abandoned during the dry season. On the contrary, the dry season is a period of great activity, and it is the season when most, if not all, the food-supply is gathered. Moreover, it would be a physical impossibility for a gravid queen to leave a termitarium; and it is hardly conceivable that the workers and soldiers would abandon her and the thousands of eggs and young larvæ, upon which the welfare of the community depends, to seek shelter in the few tunnels outside the mound, even were these roomy enough to accommodate them.

It is also erroneously stated by popular writers and others, that these great structures are built of earth mined from below. Doubtless, the small quantity of earth removed in making foraging tunnels is used in constructing the termitaria, but when we consider how few and small these tunnels are, it is obvious that the quantity of building-material obtained from them must be very limited. With the exception of one species of *Eutermes*, which builds a very small mound, all the termites found in the Territory collect the great bulk of the earth and sand used in their termitaria, upon the surface.

RHINOTERMES RETICULATUS Froggatt.

Froggatt, *op. cit.*, 1896, p.540.

This a common and very destructive species often found in dead trees, fence-posts, stacks of timber, and in boxes, benches, jute and cotton goods, harness, etc., stored in outhouses.

As a rule, they work under cover of an enveloping crust of earthy material, and their detection is easy; but, sometimes, considerable damage is done before they make their appearance on exposed surfaces. Regular termitaria or mounds are rarely, if ever, constructed in the northern part of the Territory, nor are the young reared in trees, logs, etc., either on or above the surface of the ground. It is a rule that the workers and soldiers make their way in tunnels from distant underground nests, coming up under the box or log, as the case may be, covering it with a thin earthy crust, and rapidly reducing it to a mere shell. Occasionally, one finds large nymphæ with rudimentary wings, or, late in the wet season, fully developed winged insects in such positions, but the young larvæ, nymphs, and eggs are not found in these feeding-places. Although frequent attempts have been made to follow these tunnels back to the nests, the writer has never met with success, either owing to the fact that they were lost under buildings, or in ground where it was impossible to keep their course.

One termitarium, possibly proving the exception to the rule that *Rhinotermes* do not build mounds, was found at Batchelor. This was a black, cone-shaped mass of earth and triturated wood, 18 inches high, by 12 inches in diameter at the base, built at the side of a stump, which itself was enveloped in a crust of similar composition. Both the stump and the termitarium swarmed with termites, but the latter contained no queen or young. The structure resembled others in the vicinity, which were occupied by *Eutermes*, excepting that it differed somewhat in the amount of wood in its composition.

Winged swarms appear in Darwin about the beginning of March.

Lepisma sp., and the small Tenebrionid beetle, *Aphitobius piceus* Oll., are frequently associated with these termites.

The larvæ of a Tachinid fly destroy *Rhinotermes* under natural conditions, but they are too rare to constitute an effective natural control (two examples only have been taken by the writer). The parasites were taken in termite-galleries under a log, at Batchelor, on 10th July. Each was surrounded by about eighty dead

termites, which they had sucked dry. In captivity, they destroyed, in two days, 25 and 28 *Rhinotermes*, then pupated after resting two days. One fly emerged on 26th; the other pupa failed to mature.

RHINOTERMES INTERMEDIUS Brauer.

Brauer, *Reise Novara*, Zool. Th., Neuroptera, p.49.

This species is not so common as *R. reticulatus* in the neighbourhood of Darwin.

Winged forms, soldiers (major and minor types), and workers were taken under a stack of wood in Darwin, on 29th November; and a month later, numbers of winged insects were taken at a lamp in the vicinity. The nest was situated, apparently, under the floor of an outhouse, up to which point a number of tunnels were traced.

The habits of the two species of this genus appear to be similar. Swarming takes place at night, when large numbers are attracted by lights, and find their way into houses.

The individuals of a swarm, after a short flight, settle on the ground, spread their wings, and move backwards until these are broken off at the cross-sutures. The males are generally the first to shed the wings, the females sometimes retaining one or more until after mating. Immediately the wings are dropped, the males follow the females until a crevice is found under a piece of wood, bark, or tussock of grass, where mating takes place. Couples placed in breeding-jars partly filled with loam, mated under chips of wood, then burrowed down into the soil, where they lived only five or six days.

Loc.—Darwin.

CALOTERMES IRREGULARIS Froggatt.

Froggatt, *op. cit.*, 1896, p.525.

This genus appears to be represented in the Territory by the above species only. It is a rare termite, only one colony having been found by the writer.

While investigating the cause of a gummy exudation from the fork of a small, unidentified, exotic tree in the Botanic Gardens, Darwin, on 22nd July, many larvæ of a large fruit-fly (*Dacus* sp.)

were found in the trunk, about three feet from the ground, crawling in a mass of comminuted wood saturated with gum and offensive-smelling fluid. On splitting the trunk downwards, the termites were found in irregular vertical passages through the green wood to a depth of about twelve inches from the fork. The passages were partly filled with comminuted wood, gum, and fluid, and were inhabited by the termites and fruit-fly larvæ. The extremities of the passages were drier, and were occupied chiefly by termites of the worker-caste. The individuals comprised about 100 soldiers, about 400 adult workers, one male (the king), a number of larvæ and nymphæ (measuring up to 4 mm. in length), and about 50 eggs. The queen was evidently shaken out, and lost in the long grass, which surrounded the trunk. The majority of these were secured as specimens, and the remainder, about 12 soldiers, 50 adult workers, and numerous nymphæ, were removed, with several fruit-fly larvæ, in portion of the stump to a breeding-jar.

The remaining portion of the stump was examined, and found to be intact for a height of 2 feet from the ground. There was no trace of an external coverway up the outer side, or a passage up the interior from the ground, such as are always found when trees are attacked by other species of termites known to the writer. In this case, the tree was attacked at the fork, about three feet from the ground, and hollowed out to within about one-eighth of an inch of the bark.

The fruit-fly larvæ pupated between 8th and 15th August, and the flies emerged between 1st and 9th September.

Up to 5th August, none of the nymphæ showed developing wing-pads, nor could any of them be differentiated as destined to become soldiers or complementary queens. On 1st September, three, young, complementary queens were found amongst the nymphæ, one of which was preserved, while the remaining two were kept alive for observation. On 22nd September, many of the nymphæ could be separated, by the development which had taken place in the meso- and metanota since 5th August, as destined to become winged-forms. The little colony was now well established, and should have provided a good deal of inter-

esting data, had it not died out from want of attention during the writer's absence.

This species is too rare to be regarded as an economic pest of importance.

EXPLANATION OF PLATES XIV.-XXIII.

Plate xiv.

Fig.1.—Termitarium of *Coptotermes acinaciformis* Froggatt; Koolpinyah, N.T.

Plate xv.

Fig.2.—Termitarium of *C. acinaciformis*; Stapleton, N.T.

Plate xvi.

Fig.3.—Section of termitarium of *C. acinaciformis*; Batchelor, N.T.

Plate xvii.

Fig.4.—Termitarium of *C. acinaciformis* in termitarium of *Eutermes triodia*; Stapleton, N.T.

Plate xviii.

Fig.5.—Termitarium of *C. acinaciformis* in termitarium of *Eutermes triodia*; Stapleton, N.T.

Plate xix.

Fig.6.—Termitarium of *Eutermes pastinator*, showing recently added portion; Stapleton, N.T.

Fig.7.—Termitarium of *Eutermes pastinator*; recently added portion broken away, to show numerous holes in wall of older portion; Stapleton, N.T.

Plate xx.

Fig.8.—Typical termitaria of *Eutermes triodia*; 34-Mile Siding, N.T. Railway.

Plate xxi.

Fig.9.—Large termitarium of *Eutermes triodia*; 34-Mile Siding, N.T. Railway.

Plate xxii.

Fig.10.—An unusual form of termitarium of *Eutermes triodia*; 34-Mile Siding, N.T. Railway.

Plate xxiii.

Fig.11.—Termitarium of *Eutermes triodia*; Batchelor, N.T.